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# EDUCATION, PUBLICATION, COMMUNICATION, AND COMMERCIALIZATION

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## ***Project Description***

The CATM Program continues to provide scientific and technical information on trace metals to interested parties and stakeholders in research organizations; federal, state, and local agencies; and the energy and environmental industry. In addition, CATM encourages and supports activities that provide training and educational opportunities for students, professionals, and outreach to the general public.

The CATM Program continues to provide improved educational courses and materials that make students and the public more aware of environmental issues and serve as reference documents to the scientific community (1–13). With respect to education, the goals of the CATM Program are consistent with EPA goals which state that “Increased information exchange between scientists, public health officials, businesses, citizens, and all levels of government will foster greater knowledge about the environment and what can be done to protect it” (14, 15). As one of the Centers of Excellence within the EERC, CATM continues to be instrumental in focusing attention on these issues in various public forums, both domestically and abroad.

Additionally, CATM strives to develop and demonstrate products and technologies that aid in emission characterization, measurement, prevention, and/or control. As concepts evolve, CATM works with partners to commercialize these technologies in the marketplace. To ensure that these goals, as well as the overall goals of CATM, are met, EPA has conducted on-site peer review of the CATM Program. The outcome of these reviews has been very positive, with the most recent review complimenting CATM as “one of EPA’s best centers” (16).

## ***Goal***

Specific goals for CATM are as follows:

- Prepare, publish, and present information regarding issues related to air toxic metals and CATM research at conferences and workshops and in peer-reviewed journals and conference proceedings for the benefit of stakeholders and the general research community.

- Provide educational opportunities for students through CATM research.
- Promote technology development and commercialization.

### ***Rationale***

Because of increasing global environmental concerns, training, education, and dissemination of up-to-date information to stakeholders in government agencies (especially EPA and the U.S. Department of Energy [DOE]), research and educational institutions, and industry in a timely manner are critical. Sharing and transferring cutting-edge research findings to industry, environmental groups, state agencies, and EPA have been instrumental in establishing scientifically based regulatory standards. CATM will continue to provide valid and timely information to those decision makers who must implement policy, evaluate environmental and health impacts, and determine the most judicious course of action in light of the most recent information.

### ***Approach***

The release of EPA's Clean Air Mercury Rule, while long expected, has served to heighten interest in solving mercury control issues and stakeholders have become even more eager to obtain research that addresses characterization, measurement, and control of mercury emissions. As states and regions forge regulations of their own, stakeholders are seeking scientifically sound solutions to these challenges. In addition, this regulation has served to heighten the public's awareness of other pollutants. In order to address an audience with varying levels of knowledge and sophistication, several vehicles of communication are necessary to ensure that this critical information reaches those who need it most.

To facilitate the transfer of information to government, research organizations, academia, industry, and the general public, CATM continues to support efforts to transfer timely scientific knowledge including the following venues: 1) coordination of the CATM annual meeting in conjunction with EPA, Program Affiliates, and the Research Advisory Council (RAC); 2) coordination and sponsorship of the Air Quality VI Conference: Mercury, Trace Elements, SO<sub>3</sub>, and Particulate Matter (AQVI) and Western Fuels Symposium, as well as participation and presentation at other conferences or forums that are directed to stakeholders; 3) distribution of the *CATM Newsletter*; 4) updating and maintaining the CATM Web page; 5) serving on environmental advisory committees; 6) education through various publications and workshops; and 7) overall administration of the CATM Program.

### ***Progress***

#### **Meetings**

The twelfth annual CATM RAC meeting was held at the Marriott Crystal Gateway Hotel in Arlington, Virginia, on September 18, 2005, in conjunction with the AQV Conference. This meeting provides a forum by which industry, government, and the research community can exchange information on CATM results and provide direction for future CATM research, development, and commercialization programs. Fifteen people participated, representing government (including EPA and DOE), industry, and other research organizations. Of particular interest was CATM research into mercury control technologies, ongoing research into the health effects of mercury, new methodologies for measurement of trace metals, and continued development of a model that explains the possible means by which activated carbon sorbs mercury and flue gas interferences that reduce the capacity of the carbon. The group

expressed appreciation for CATM's continued role in communicating about appropriate technologies for emission control of various air pollutants.

The group also stressed the importance of CATM researchers presenting the most current information possible via conferences and workshops to disseminate relevant information in the most timely manner possible. CATM's staff has increasing visibility and enhanced standing in the international community by taking advantage of opportunities to present results of CATM and EERC mercury research. CATM staff has had the opportunity to address the Canadian Council of Ministers of the Environment, as well as becoming an integral part of the ongoing international dialogue concerning mercury control issues. CATM's staff has continued to present special workshops in connection with conferences as a means of disseminating this information. For example, CATM's staff is presently assisting to coordinate a special session for the 8th International Conference on Mercury as a Global Pollutant. CATM's Director is also involved in ongoing discussions and conferences for the Mercury Environmental Conference.

### **CATM Newsletter**

A large issue of the *CATM Newsletter* was published and distributed to industry and other interested parties throughout the United States and 40 countries. Feedback regarding this summary of mercury-related research has been very positive. In particular, many Canadian stakeholders have been requesting the newsletter and have consequently had numerous discussions with the CATM Director and others at the EERC regarding technical issues related to compliance with U.S. and Canadian mercury regulations. The newsletter is designed to inform interested parties on air toxic issues and CATM activities and to encourage further participation and collaboration between industry and government. Upcoming issues of the newsletter will feature articles regarding CATM research related to mercury-selenium health issues and ongoing mercury issues, including the "Appendix K" dry sorbent method of mercury measurement. The newsletter, along with topical mercury reports published through the Canadian Electricity Association (CEA), can be accessed electronically via the CATM Web site at [www.undeerc.org/catm](http://www.undeerc.org/catm), a fact that many recipients have appreciated.

### **CATM Web Page**

The CATM Web page continues to serve as a vehicle for easy access to recent developments and results from the CATM Program. General information about CATM is also maintained and includes background; role and activities; accomplishments; key education and training activities: conferences, short courses, workshops, and academic programs; and CATM personnel.

### **Committees**

CATM researchers and managers continue to serve on several advisory committees to provide expert advice and technical guidance on a number of issues related to air toxics. Below are a few of the committees that CATM researchers serve on:

- Binational Strategy Utility Mercury Reduction Committee
- AQVI Planning Committee
- International Mercury Conference Planning Committee (International Conferences on Mercury as a Global Pollutant and Mercury Environmental Conferences)
- North Dakota Mercury Task Force
- Subbituminous Energy Coalition (SEC)
- Western Fuels Symposium Technical Director
- American Chemical Society (ACS) 2004 Chair, Fuel Division

- ACS, Executive Committee, Fuel Division
- ACS, Councilor, Fuel Division
- ASME Committee on Corrosion and Deposition Resulting from Impurities in Gas Streams, Advisory Member
- Elsevier Science, *Fuel Processing Technology*, Editorial Board Member

### **Education Through Publications**

CATM disseminates information in several ways. In 2005, eight refereed journal articles were published and four more were in preparation. In addition, one paper was submitted to the American Chemical Society Fuel Chemistry Division Preprints, a well-respected journal that is not refereed.

“Status Review of Mercury Control Options for Coal-Fired Power Plants,” published in a special issue of *Fuel Processing Technology* in August 2003, is being updated, broadened in scope, and will be submitted for publication by a peer-reviewed journal. CATM staff are presently working on this document.

In 2005, ten CATM papers were included in books and bound proceedings. Four books or bound proceedings were published.

CATM has also been involved in several related project reports. CATM staff members also gave presentations at and participated in several conferences and workshops throughout the year. In 2005, CATM researchers presented 15 papers at conferences and workshops around the world, with some noted above. In addition to attending workshops and conferences, CATM is also organizing and coordinating the Western Fuels Symposium in October 2006 and the AQVI Conference for September 2007.

### **Educational Opportunities for Students**

Through CATM, numerous students have been involved in hands-on research into air toxic metal and related research. Not only does this provide access to research opportunities with key researchers in this area, but it provides a venue for students to be active participants while gaining valuable insights into the scientific and technical issues that face us on a local, regional, and global level. In addition to this benefit, these students enter the energy and environmental fields with real-world knowledge that increases their worth to employers.

In 2005, two doctoral students, Carla Jordan and Alexander Azenkeng, were involved in CATM research. Yongzin Zhao, a previous master’s degree student who worked on CATM research, completed his master’s thesis entitled “Investigation on Mercury Chlorine and Capture.” In addition, nine undergraduate students were involved in various aspects of CATM research projects.

### ***Status***

Educational and information-sharing activities will continue throughout the year. Involvement in community environmental activities will continue, as well as the programs in place to reach out to and help area schools in their efforts to educate students and teachers on energy and environmental issues.

In 2005, CATM was involved in a well-received workshop covering mercury for engineering students at the University of North Dakota. The feedback from the students indicated they found this real-world application of engineering concepts very valuable.

The newsletters and the CATM Web site have also become valuable outlets for disseminating information, and both will continue to provide valuable up-to-date information. The CATM Web page has been maintained throughout the year and can be accessed at [www.undeerc.org/catm](http://www.undeerc.org/catm). Copies of the *CATM Newsletter* and the CEA topical reports related to mercury are available for download to the general public via the CATM Web page.

### ***Quality Assurance/Quality Control***

The EERC is committed to delivering consistent, high-quality research. An organizationwide quality management system (QMS), authorized and supported by EERC managers, is in effect and governs all programs within the organization. The EERC established and formalized a QMS in August 1988. A quality manual defines the requirements and the organizational responsibilities for each major element of the QMS and references the supporting documents needed to provide a comprehensive program. Compliance with this manual and its supporting documents ensures that the EERC adequately fulfills governmental and private client requirements relating to quality and compliance with applicable regulations, codes, and protocols. Additionally, the CATM Program at the EERC has a quality assurance (QA) plan in effect that addresses trace metal research (16). The CATM QA plan has been reviewed and accepted by EPA. The project reported on herein has complied with the quality manual, the CATM QA plan, and all revisions. An independent QA auditor has reviewed all aspects of QA/quality control associated with this project and report.

### ***Potential Users/Technology Transfer***

Stakeholders from industry, government agencies (specifically EPA and DOE), and the general scientific community will benefit from the results of the project, with information and data that will provide a much better understanding of air toxic issues and the control of air toxic emissions. The new information coming out of CATM's health effects area is also proving to have far-reaching impact. The general public will benefit through the publication of refereed papers and documents, college courses, workshops, and numerous outreach programs initiated and supported by CATM.

### ***References***

1. CATM Staff. *2004 Annual Report of the Center for Air Toxic Metals*; Energy & Environmental Research Center: Grand Forks, ND, June 2004.
2. Pavlish, J.H.; Galbreath, K.C.; Zygarlicke, C.J.; Benson, S.A., Miller, S.J., Holmes, M.J. *Center for Air Toxic Metals Final Technical Report: Volume IV*; EPA Assistance Agreement CR824854; Energy & Environmental Research Center: Grand Forks, ND, Sept 2004.
3. CATM Staff. *2003 Annual Report of the Center for Air Toxic Metals*; Energy & Environmental Research Center: Grand Forks, ND, May 2004.
4. Sondreal, E.A.; Benson, S.A.; Pavlish, J.H.; Galbreath, K.C.; Zygarlicke, C.J.; Thompson, J.S.; McCollor, D.P.; Crocker, C.R.; Lillemoen, C.M.; Mann, M.D.; Jensen, R.R.; Weber, G.F. *Center for Air Toxic Metals Final Technical Report: Volume III*; EPA Assistance Agreement CR 824854; Energy & Environmental Research Center: Grand Forks, ND, Sept 2000.

5. CATM Staff. *2002 Annual Report of the Center for Air Toxic Metals*; Energy & Environmental Research Center: Grand Forks, ND, Feb 2003.
6. CATM Staff. *2001 Annual Report of the Center for Air Toxic Metals*; Energy & Environmental Research Center: Grand Forks, ND, March 2002.
7. CATM Staff. *2000 Annual Report of the Center for Air Toxic Metals*; Energy & Environmental Research Center: Grand Forks, ND, March 2001.
8. CATM Staff. *1999 Annual Report of the Center for Air Toxic Metals*; Energy & Environmental Research Center: Grand Forks, ND, March 2000.
9. CATM Staff. *1997–1998 Annual Report of the Center for Air Toxic Metals*; Energy & Environmental Research Center: Grand Forks, ND, Feb 1999.
10. CATM Staff. *1996–1997 Annual Report of the Center for Air Toxic Metals*; Energy & Environmental Research Center: Grand Forks, ND, Feb 1998.
11. Benson, S.A.; Pavlish, J.H.; Zygarlicke, C.J.; Erickson, T.A.; Schelkoph, G.L.; O’Leary, E.M.; Timpe, R.C.; Anderson, C.A. *Center for Air Toxic Metals Year 2 and 3 Final Technical Report*; EPA Assistance Agreement C R 823173; Energy & Environmental Research Center: Grand Forks, ND, April 1998.
12. CATM Staff. *1995–1996 Annual Report of the Center for Air Toxic Metals*; Energy & Environmental Research Center: Grand Forks, ND, Feb 1997.
13. Benson, S.A.; Pavlish, J.H.; Erickson, T.A.; Katrinak, K.A.; Miller, S.J.; Steadman, E.N.; Zygarlicke, C.J.; Dunham, G.E.; Pflughoeft-Hassett, D.F.; Galbreath, K.C. *Center for Air Toxic Metals Year 1 Final Technical Report*; EPA Assistance Agreement C R 821518; Energy & Environmental Research Center: Grand Forks, ND, April 1996.
14. U.S. Environmental Protection Agency. *EPA Strategic Plan*; EPA-190-R-97-002, EPA: Washington, DC, Sept 1997.
15. U.S. Environmental Protection Agency. *2003–2008 EPA Strategic Plan: Direction for the Future*; EPA-190-R-03-003, EPA: Washington, DC, Sept 2003.
16. U.S. Environmental Protection Agency. *Center for Air Toxic Metals Scientific and Institutional Peer Review*, Energy & Environmental Research Center: Grand Forks, ND, April 23–25, 2003.
17. EERC Staff. *Quality Manual*; Energy & Environmental Research Center: Grand Forks, ND, 2004; Issue 2, Revision 2.